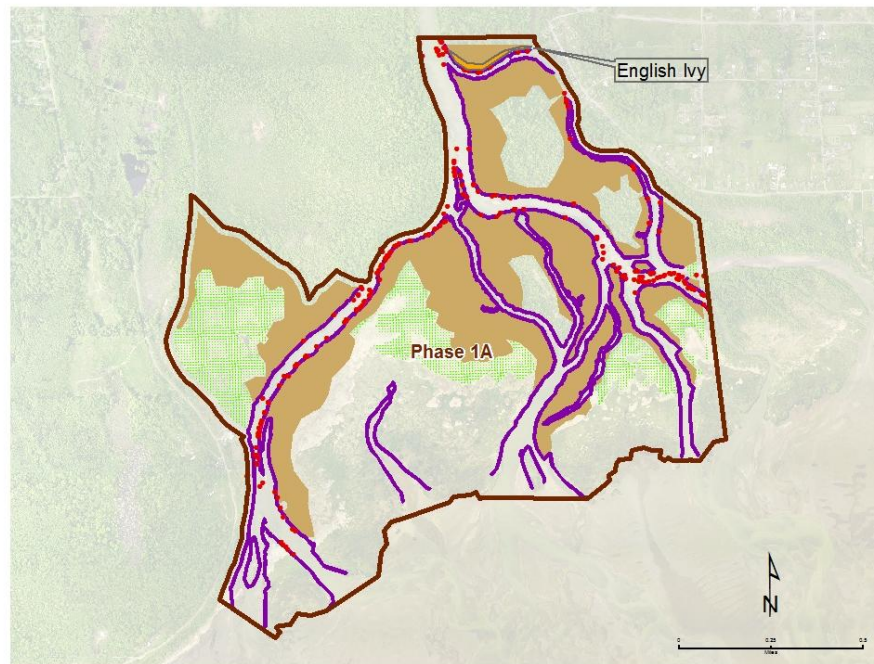


**Lummi Nation Wetland and Habitat Mitigation Bank
2014 (Year 1) Monitoring Report for 2013 Enhancement Areas
Phase 1A Nooksack Delta Site**



Prepared For:

Interagency Review Team
Lummi Nation Wetland and Habitat Mitigation Bank

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EXECUTIVE SUMMARY

Summary of Year 1 Monitoring Activities for 2013 Enhancements	
Name of Mitigation Bank	Lummi Nation Wetland and Habitat Mitigation Bank
Bank Phase	Phase 1A
U.S. Army Corps of Engineers Reference Number	NWS-2008-1519-SO
Bank Sponsor	Lummi Natural Resources Department
Project Lead	Jeremy R. Freimund, P.H.; Water Resources Manager; jeremyf@lummi-nsn.gov; 360-312-2314
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Monitoring Dates:	Sept. 15, 2014 to October 10, 2014

INTRODUCTION

The purpose of this Year 1 Monitoring Report is to document the monitoring results for the enhancement activities conducted during 2013 for Phase 1A of the Lummi Nation Wetland and Habitat Mitigation Bank (Bank). Phase 1A is located at the Nooksack Delta Site. A 2013 As-Planted Report, which documents the enhancement activities conducted during 2013, was submitted to the Interagency Review Team (IRT) during October 2014. The Year 1 monitoring of the 2013 enhancement activities was conducted during the fall of 2014.

This monitoring report is part of the documentation required to demonstrate attainment of the performance standards established in the Mitigation Banking Instrument (MBI). The IRT must review and approve the documentation as a condition of awarding and releasing additional Bank credits. The IRT award of credits will be reflected in a letter issued using IRT letterhead and signed by the IRT Chair (i.e., the U.S. Army Corps of Engineers, District Engineer or his/her designee).

Documentation of the Baseline Vegetation Conditions of the Nooksack Delta Site – Phase 1A was completed in December 2010 and accepted by the IRT. Because of the limited planting window and anticipation that the MBI would be executed during the second quarter of 2011, enhancement activities were initiated during the first quarter of 2011. Although the MBI was not executed until July 6, 2012, the IRT stated that the December 2010 Baseline Vegetation Conditions report would be the basis for evaluating attainment of the performance standards identified in the MBI.

The overall monitoring and reporting schedule for the Bank development period is shown in Table 1. Monitoring and reporting will be conducted for 10 years for each stage of the Bank development, beginning with Year 0 for each treatment area completed. The Year 0 report is in the form of an “As-Planted Report”. Because of the large area where enhancement activities are occurring, it is not possible to treat all areas within a single year. Consequently, treatment is occurring in stages. Treatment in all areas was expected to take 4 years (i.e. 4 stages); therefore, the overall schedule was expected to extend for 14 years. Monitoring reports for the earlier stages of the Phase 1A site development will continue beyond Year 10 until Year 10 is reached for the latest planting stage.

Table 1. Phase 1A Monitoring and Reporting Schedule

Action	Year ¹										
	0	1	2	3	4	5	6	7	8	9	10
Monitor Reed Canarygrass and Yellow Flag Iris and Shrub Plantings	x ²	x		x		x		x			x
English Ivy	x ²	x		x		x		x			x
Monitor Knotweed	x ²	x	x	x	x	x	x	x	x	x	x
Monitor Conifer Underplantings	x ²	x		x		x		x			x
Monitoring Reports	As-planted report ²	x	x	x	x	x		x			x

¹ Monitoring and reporting will be conducted for 10 years for each stage of the Bank development beginning with Year 0 for each treatment area completed. Treatment in all areas is expected to take at least 4 years; therefore the overall schedule will extend for at least 14 years. As described below, monitoring reports for the earlier stages of the Phase 1A site development will continue beyond Year 10 until Year 10 is reached for the latest planting stage.

² Documentation of enhancement actions (“As-Planted Reports”).

PHASE 1A DESIGN PLAN SUMMARY

The enhancement design for the Phase 1A Nooksack Delta Site is focused on (1) removing and managing invasive plant species; and (2) increasing native plant species richness through planting native shrubs and coniferous trees. Following the weed control effort and plantings, the primary work on the site will involve monitoring and maintenance activities.

The Nooksack Delta Site Phase 1A enhancement design is comprised of the following elements in the general sequence that they will occur:

1. Designate and protect the land within the site through a conservation easement;
2. Eradicate or control invasive species;
3. Plant native conifer species within the deciduous forests; and
4. Monitor effectiveness of treatments and underplantings, and repeat as needed to meet performance standards.

The mitigation bank locations in Phase 1A where enhancement activities occurred during 2013 and that were monitored during 2014 (Year 1) are shown on Figure 1 through

Figure 3. It is noted that work completed during 2013 included replanting portions of 480 of the 679 willow plots (71%) that were planted during 2012 and that had low success rates. The replanted areas are not depicted in Figure 1. Specific design elements for the enhancement areas are summarized in Table 2 and further described below.

Table 2. Phase 1A Enhancement Actions Completed in 2013

Type of Wetland Enhancement Action	Area (acres)
Knotweed removal: treatment and monitoring area	0
Weed removal/willow planting: reed canarygrass, yellow flag iris	0.8
Weed removal: English ivy	0
Conifer underplanting	17.0
Total Enhancement Area for 2012	17.8

BANK OBJECTIVES AND PERFORMANCE STANDARDS

The Bank's success will be measured by documenting progress toward achieving the objectives and associated performance standards identified in the MBI. The prescribed performance standards are intended to measure the success of the ecological restoration and enhancement efforts at the Bank. Only the Phase 1A performance standards related to the work performed in 2012 (Year 0 for this stage) are described below.

Objective 1: Permanently protect aquatic ecosystem functions of the Nooksack Delta Site by instituting the MBI and implementing a conservation easement with permanent funding for site stewardship.

Performance Standard: The conservation easement and financial assurances are included in the MBI. The IRT approved the MBI on July 6, 2012 and the Conservation Easement was approved by all parties and recorded on October 17, 2012. The IRT released 19 credits on October 18, 2012.

Objective 2: Enhance ecological function by removing and managing reed canarygrass and yellow flag iris and replanting with native shrubs.

Performance Standard 2B: Areal cover of native shrubs in treatment area (shrub patches) at least 20% by Year 3. Visual estimates of plant cover within 5% of the treatment areas (shrub patches) and photographs of each patch sampled.

Objective 4: Enhance long-term forested wetland ecological function and habitat for federally listed fish species (Chinook, steelhead, and bull trout) by planting conifers

beneath deciduous trees in the existing forested areas and along the many stream channels.

Performance Standard: 4B: A minimum of 220 living trees per acre by August-September of Year 1. Tree density will be estimated by counting live trees within permanent “belt” transects. Sample size will include at least 5% of total area planted for each planting year.

YEAR 1 (2014) MONITORING OF PHASE 1A AREAS ENHANCED IN 2013

The new areas where enhancement actions were completed in 2013 are shown on Figure 1 and summarized in Table 2. As described in the 2013 As-Planted Report, work completed during 2013 included replanting portions of 480 of the 679 shrub plots (71%) planted during 2012 that had low success rates and planting an additional 0.8 acres of reed canarygrass treatment and willow plantings. The 2012 plots that were replanted during 2013 were replanted with between 10 to 25 stakes per plot – the 311 willow plots in the eastern portion of the 2012 planting area averaged about 22 replanted willow stakes per plot. In addition, willows were planted within 17 new plots each measuring approximately 20 feet in diameter near the southeastern corner of the 2012 planting area. Only the newly planted areas are shown in Figure 1 and Figure 2. Work completed in 2013 also included planting conifer seedlings in the areas depicted in Figure 1 and Figure 3.

Reed Canarygrass/Yellow Flag Iris Treatment and Willow Plantings

Work completed during 2013 includes 0.8 acres of reed canarygrass treatment and willow plantings. Willows were planted within 17 plots each measuring approximately 20 feet in diameter. The locations for the plots planted with willow stakes in 2013 were established in a grid pattern with 40-foot on center spacing using a Geographic Information System (GIS). The latitude and longitude of each of the plots was then loaded from the GIS into a mapping grade, hand-held global positioning system (GPS) unit with a horizontal accuracy of ± 2 feet (Trimble GeoXT). The GPS unit was used to locate the plot centers in the field (see Figure 2). Each plot was designated with a unique identifier (WP2013001 – WP2013017) for data tracking purposes and a wood lathe with the unique identifier number written on it was used to mark the plot center. Survey flagging was attached to the wood lathe to help field locate the plot centers.

Three species of willow stakes were planted: Pacific (*Salix lasiandra*), Sitka (*S. sitchensis*), and Hooker’s (*S. hookeriana*). Stake spacing averaged 2 to 3 feet on center (approximately 57 stems per plot or 1,425 stems per acre).

A total of 10,000 willow stakes were planted in Phase 1A during 2013. Approximately 969 willows were planted within the 17 plots in 2013 over the April 3 through April 11, 2013 period and the remaining willow stakes were used to replant plots that suffered

heavy mortality due to predation or arid conditions in 2012. In some of the plots, the planting density was reduced due to unsuitable planting conditions (e.g., large woody debris, deep holes/excessive water depth) encountered in the field. Following the planting season, the GIS was used to draw a polygon around the planted plot locations, which had been located in the field using the GPS. Using this approach, the overall treatment area for 2013 was determined to be 0.8 acres.

Monitoring of the newly planted willow patches was conducted at one randomly selected plots covering 5% of the total number of plots. The plot selected for sampling is shown in red in Figure 2. Five photographs were taken at the sample plot in 2013 to document changes in shrub cover over time. One photograph of the sample plots is provided in Appendix A.

Monitoring results will be compared with performance standards described in Table C.2 of the MBI.

Aerial Shrub Cover within Willow Plots

Performance standards for the willow planting plots include at least 20% areal coverage by native shrubs within planted plots by Year 3 (which will be during 2016 for the areas treated during 2013). At the randomly selected plot, the cover provided by native willows was visually estimated. Two staff members made estimates of aerial cover and compared estimates. The average of the two estimates was recorded.

Results of the aerial coverage estimates are shown in Table 3. Shrub cover was estimated to average 1.0% with a standard error (SE) of 0.0 for the plot monitored at the end of the Year1 (2014) growing season. The average coverage provided by native shrubs at the sample plot decreased from 3.0% (SE 0) in Year 0 to 1.0% (SE 0) in Year 1. The modest decrease in cover is the result of some willow stakes dying between years. The 1% cover estimate does not meet the performance standard of 10% by Year 1 as described in the MBI. Although growth was vigorous on many of the live willow stems, growth was also vigorous for the reed canary grass and many dead willow stems were observed within the sampled plot. Evidence of bark browsing (probably due to voles) was observed on many of the dead stems. Stems drying prior to planting or dry conditions during the summer establishment period may also have contributed to stem death, which resulted in a decrease in shrub cover. Replanting of some willow plots may be necessary in order to meet Year 3 performance standards of 20% shrub cover.

Table 3. Willow Aerial Coverage – 2013 Plantings (5% of total shrub plots)

Station Identifier	Shrub Cover (Baseline)	Shrub Cover Year 1 (%)
WP20130016	3.0	1.0

Diameter of Willow Plots

Performance standards for the willow planting plots also include an increase in the diameter of the plot in later years (Year 7 and Year 10). In order to provide a basis of comparison for the future diameter of the plots, the diameter of the plots was measured in the fall of the year the enhancement activity occurred. Three measurements of the plot diameter were made at each sample plot and averaged for each plot. Diameter measurements were taken near the end of the growing season using a fiberglass tape stretched through the center of the plot (marked with wood lath). Measurements were made from the outermost portion of the willow stems. The mean diameter for each individual plot will be the baseline used to compare with the mean diameter that will be measured in Year 7 and Year 10.

Performance standards for Year 7 include a 10% minimum increase in plot diameter for at least one-quarter of the plots. Although performance standards for plot diameter are not required for Year 1, the diameters were measured to provide information on whether plot growth is on a positive trajectory toward achieving performance standards in later years. As summarized in Table 4 the average plot diameter has decreased 4% at the sample plot from baseline to 2013.

Table 4. Willow Plot Diameters -Year 1 of 2013 Plantings (5% of total plots)

Station Name	Mean Diameter in Year 0 (ft)	Mean Diameter in Year 1 (ft)	Year 1 (% Change)	Target Diameter (+10%) by Year 7 (ft)
WP2013001	21.9	21.0	-4.0	24.05

Conifer Underplanting

An estimated 17.0 acres of existing deciduous forest was underplanted with conifers during 2013. Twenty-three 6-foot wide belt transects were established throughout the planting area to sample the plantings. The belt transects represent 0.3 acres of area. Results of the Year 0 sampling showed that trees were planted at a density of 335.5 trees per acre (standard error of 42.7). The mean height of the trees that were measured was 2.28 ft at the end of Year 0. At the end of Year 1, sampling showed that the average density of conifer plantings was reduced to 212.8 trees per acre (standard error of 36.9) within the 23 belt transects. The mean height of the trees that were measured during the Year 1 monitoring was 2.25 ft. The 212.8 trees per acre density of conifers did not meet the monitoring Year 1 MBI performance standards that require 220 trees per acre. Consequently, additional conifer planting will need to occur within the 2013 conifer enhancement area.

SUMMARY

The enhancement actions taken in 2013 (willow plantings and conifer planting) were monitored during the fall 2014 to determine if performance standards for Year 1 were achieved. The results of monitoring show that the willow shrub planting plots did not meet the 10% cover performance standard for Year 1. Additionally, the Year 1 performance standard of 220 conifers per acre for conifers was not achieved. Some replanting will be needed to keep on track to meet performance standards in later years.

The results of enhancement actions and monitoring are being tracked using a custom-built database. An example of the summary information reported by the database is included in Appendix C.

FIGURES

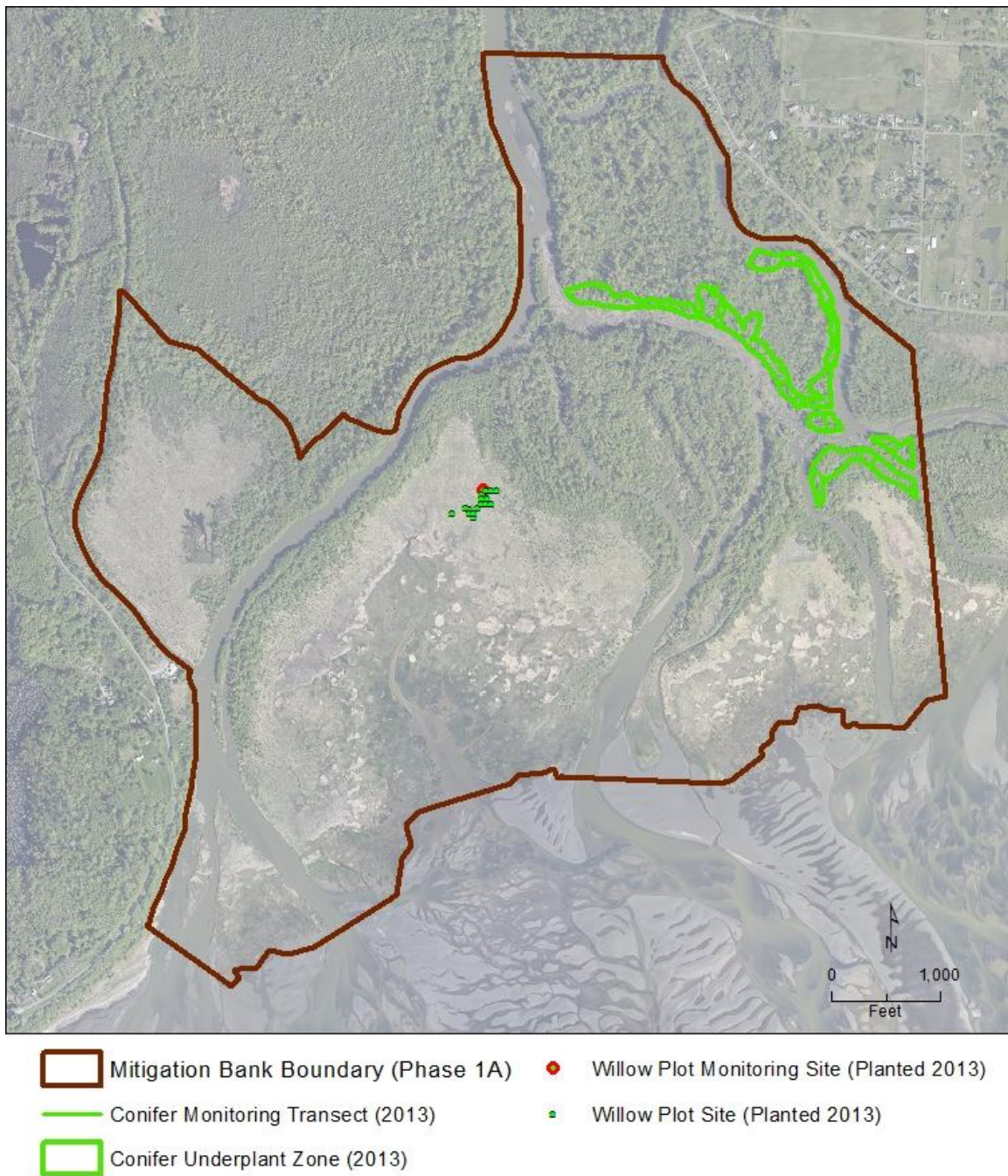
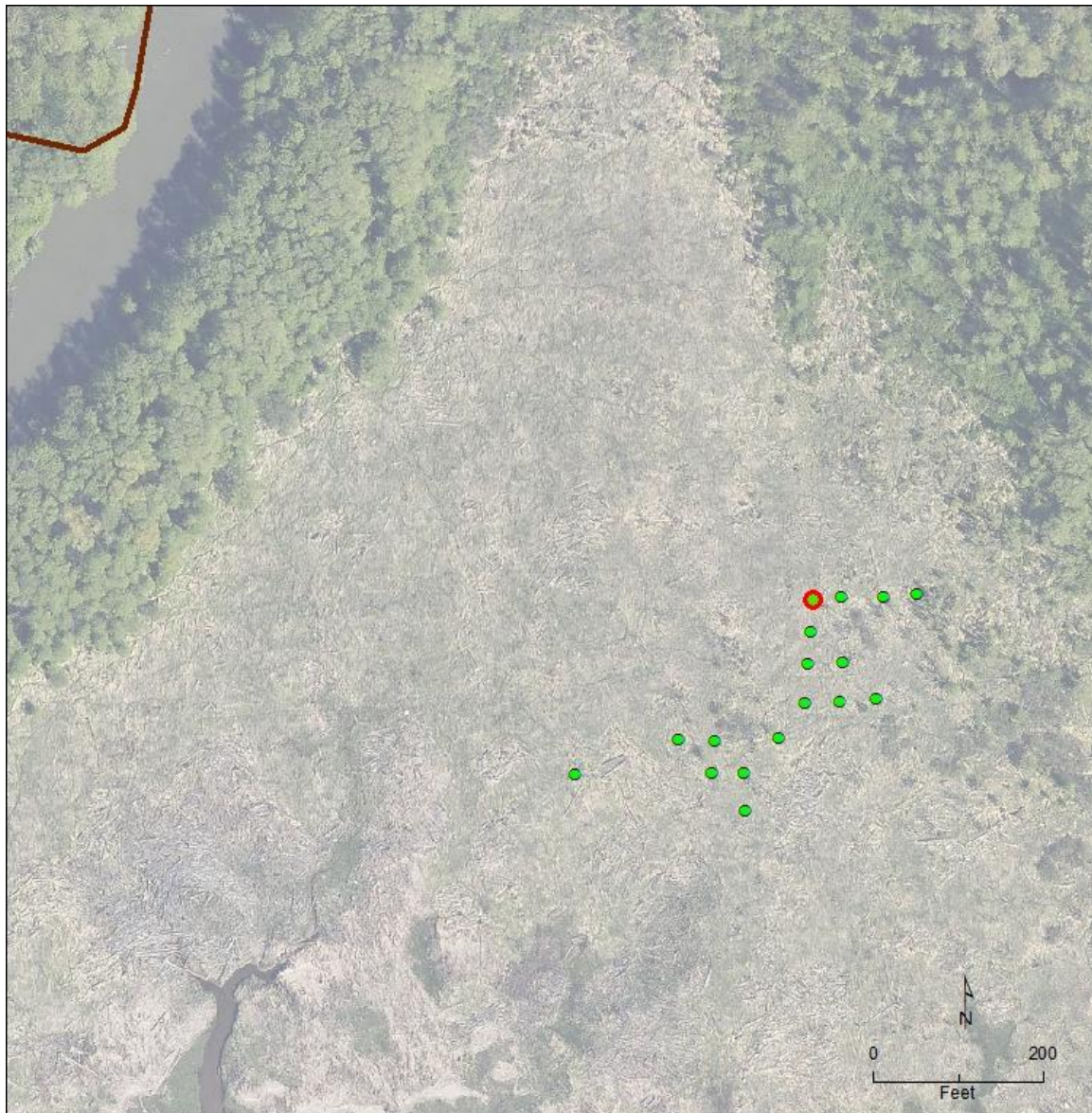


Figure 1. Phase 1A 2013 Enhancement Areas Monitored during 2014.



-  Mitigation Bank Boundary (Phase 1A)  Willow Plot Site (Planted 2013)
 Willow Plot Monitoring Site (Planted 2013)

Figure 2. 2013 Reed Canarygrass/Yellow Flag Iris Treatment and Willow Plantings Monitored during 2014 (Phase1A)

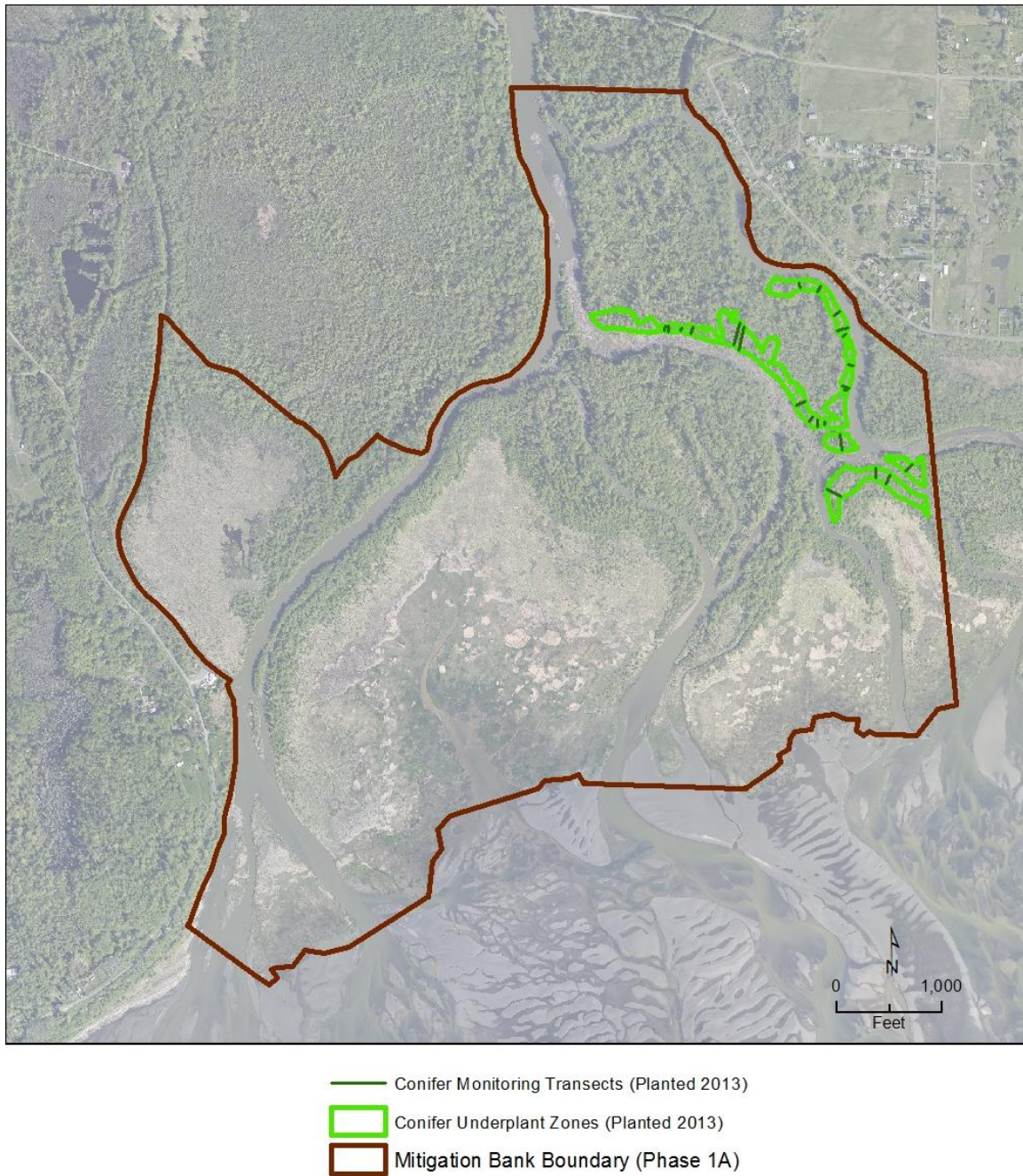


Figure 3. 2013 Conifer Underplanting Areas and Monitoring Transect Locations during 2014.

APPENDIX A: Photograph of Sample Willow Plot


(End of Year 1)





(Photographs taken in September 2014 from south end of sample plot facing north to show willows planted in 2013.)


Station Identifier	Image
WP20130016	





APPENDIX B: Photographs of Conifer Monitoring Transects





(End of Year 1)





Conifer Transect Identifier	Image From Center of Station
CT040	
CT041	
CT042	

CT043	
CT044	
CT045	
CT046	

CT047	
CT048	
CT049	
CT050	

CT051	
CT052	
CT053	
CT054	

CT055	
CT056	
CT058	
CT059	

CT060	
CT061	
CT062	
CT063	

APPENDIX C: Monitoring Database Summary Report Form

Lummi Nation Wetland and Habitat Mitigation Bank



Phase 1A Status Report

Nooksack Delta

Acres Planted/Treated in Phase 1A / Nooksack Delta

Making Willow Patches																			
2011:	2012:	2013:	2014:	2015:	2016:	2017:	2018:	2019:	2020:	2021:	2022:	2023:	2024:	2025:	2026:	2027:	2028:	2029:	2030:
29.7	29.9	0.8	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Underplanting with Conifers																			
2011:	2012:	2013:	2014:	2015:	2016:	2017:	2018:	2019:	2020:	2021:	2022:	2023:	2024:	2025:	2026:	2027:	2028:	2029:	2030:
0.0	50.5	17.0	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Acres Monitored in Belt Transects in Phase 1A / Nooksack Delta

Total Acres Monitored in Belt Transects By Stage and Year						
	M0:	M1:	M3:	M5:	M7:	M10:
2012	0.796	0	0	0	0	0
2013	0.281	0.796	0	0	0	0
2014	0.329	0.281	0	0	0	0
	1.4	1.1	0	0	0	0

Conifer Heights Monitored in Belt Transects in Phase 1A / Nooksack Delta

Tree Height Statistics by Monitoring Stage			
Stage:	Mean Height (ft)	Std.Err.	Trees Measured:
Baseline	2.3	0.02	603
M1	2.1	0.03	357

Conifer Densities Monitored in Belt Transects

Conifer Densities (Trees per Acre) by Monitoring Stage			
Stage:	Mean ConiferDensity:	StdErr:	Transects:
Baseline	461.60	30.97	68
M1	320.80	25.95	62

Ivy Cover Monitored in Ivy Plots in Phase 1A / Nooksack Delta

Ivy Percent Cover in Plots by Monitoring Stage			
Stage:	Mean Cover (%)	Std.Err.	Plots Monitored:
Baseline	30.35	8.88	17
M1	10.82	5.46	17
M3	12.94	6.02	17

Ivy Cover Monitored in Ivy Line-Intercept Stations in Phase 1A / Nooksack Delta

Ivy Percent Cover in Line-Intercept Stations by Monitoring Stage			
Stage:	MeanCoverage (%)	Std.Err.	Lines Monitored:
Baseline	42.745	28.65	5
M1	35.558	31.871	5
M3	39.012	30.146	5

Native Plant Cover Monitored in Shrub Patches in Phase 1A / Nooksack Delta

Native Plant Percent Cover in Plots by Monitoring Stage				
Stage:	MeanCoverage (%)	Std.Err.	Plots Monitored:	Precision:
Baseline	11.62	1.281	88	21.6
M1	5.55	0.527	73	18.6
M3	37.73	2.357	37	12.2

Average Patch Diameters Monitored in Shrub Patches in Phase 1A / Nooksack Delta

Percentage of Patches Exceeding Original Diameter by 10%			
Stage:	% Exceeding	% Not Exceeding	Total Patches:
Baseline	0.0	100.0	88
M1	6.8	93.2	74
M3	35.1	64.9	37

Individual Monitoring Zones in Phase 1A / Nooksack Delta

2011 Ivy Management Zone

Ivy Percent Cover in Plots by Monitoring Stage

Stage:	MeanCoverage (%)	Std.Err.	Plots Monitored:
Baseline	30.4	8.88	17
M1	10.8	5.46	17
M3	12.9	6.02	17

Ivy Percent Cover in Line-Intercept Stations by Monitoring Stag

Stage:	MeanCoverage (%)	Std.Err.	Lines Monitored:
Baseline	42.7	28.65	5
M1	35.6	31.671	5
M3	39.0	30.146	5

2011 Reed Can Grass Control Zone

Native Plant Percent Cover in Plots by Monitoring Stage

Stage:	MeanCoverage (%)	Std.Err.	Plots Monitored:
Baseline	13.7	1.173	38
M1	4.5	0.673	37
M3	37.7	2.357	37

Percentage of Patches Exceeding Original Diameter by 10

Stage:	% Exceeding	% Not Exceeding	Total Patches:
Baseline	0.0	100.0	38
M1	0.0	100.0	37
M3	35.1	64.9	37

2012 Conifer Underplanting Zone

Total Acres Monitored in Belt Transects By Stage and Year

	M0:	M1:	M3:	M5:	M7:	M10:
2012	0.796	0	0	0	0	0
2013	0	0.796	0	0	0	0
	0.8	0.796	0	0	0	0

Tree Height Statistics by Monitoring Stage

Stage:	Mean Height (ft)	Std.Err.	Trees Measured:
Baseline	2.23	0.02	463
M1	2.02	0.04	300

Conifer Densities (Trees per Acre) by Monitoring Stage

Stage:	Mean ConiferDensity:	StdErr:	Transects:
Baseline	586.83	34.39	39
M1	384.45	31.07	39

2012 Reed Can Grass Control Zone

Native Plant Percent Cover in Plots by Monitoring Stage

Stage:	MeanCoverage (%)	Std.Err.	Plots Monitored:
Baseline	5.4	1.524	35
M1	6.7	0.793	35

Percentage of Patches Exceeding Original Diameter by 10

Stage:	% Exceeding	% Not Exceeding	Total Patches:
Baseline	0.0	100.0	37
M1	13.9	86.1	36

2013 Conifer Underplanting Zone

Total Acres Monitored in Belt Transects By Stage and Year

	M0:	M1:	M3:	M5:	M7:	M10:
2013	0.281	0	0	0	0	0
2014	0	0.281	0	0	0	0
	0.3	0.281	0	0	0	0

Tree Height Statistics by Monitoring Stage

Stage:	Mean Height (ft)	Std.Err.	Trees Measured:
Baseline	2.28	0.05	95
M1	2.25	0.08	57

Conifer Densities (Trees per Acre) by Monitoring Stage

Stage:	Mean ConiferDensity:	StdErr:	Transects:
Baseline	335.53	42.74	23
M1	212.79	36.91	23

2013 Reed Can Grass Control Zone

Native Plant Percent Cover in Plots by Monitoring Stage

Stage:	MeanCoverage (%)	Std.Err.	Plots Monitored:
Baseline	3.0	0	1
M1	1.0	0	1

Percentage of Patches Exceeding Original Diameter by 10

Stage:	% Exceeding	% Not Exceeding	Total Patches:
Baseline	0.0	100.0	1
M1	0.0	100.0	1

2014 Conifer Underplanting Zone

Total Acres Monitored in Belt Transects By Stage and Year

	M0:	M1:	M3:	M5:	M7:	M10:
2014	0.329	0	0	0	0	0
	0.3	0	0	0	0	0

Tree Height Statistics by Monitoring Stage

Stage:	Mean Height (ft)	Std.Err.	Trees Measured:
Baseline	2.35	0.08	45

Conifer Densities (Trees per Acre) by Monitoring Stage

Stage:	Mean ConiferDensity:	StdErr:	Transects:
Baseline	131.39	45.11	6

2014 Reed Can Grass Control Zone

Native Plant Percent Cover in Plots by Monitoring Stage

Stage:	MeanCoverage (%)	Std.Err.	Plots Monitored:
Baseline	23.9	5.429	12

Percentage of Patches Exceeding Original Diameter by 10

Stage:	% Exceeding	% Not Exceeding	Total Patches:
Baseline	0.0	100.0	12